



## N-Channel 60-V (D-S) MOSFET

<b>PRODUCT SUMMARY</b>		
$V_{DS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (mA)
60	3 @ $V_{GS} = 10$ V	240

### FEATURES

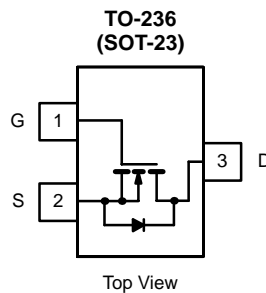
- Low On-Resistance: 3  $\Omega$
- Low Threshold: 2 V (typ)
- Low Input Capacitance: 25 pF
- Fast Switching Speed: 7.5 ns
- Low Input and Output Leakage

### BENEFITS

- Low Offset Voltage
- Low-Voltage Operation
- Easily Driven Without Buffer
- High-Speed Circuits
- Low Error Voltage

### APPLICATIONS

- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Display, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays



Marking Code: 7Ew/  
E = Part Number Code for 2N7002E  
w = Week Code  
/ = Lot Traceability

<b>ABSOLUTE MAXIMUM RATINGS (<math>T_A = 25^\circ\text{C}</math> UNLESS OTHERWISE NOTED)</b>			
Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ )	$I_D$	240	mA
		$T_A = 25^\circ\text{C}$	
		190	$T_A = 70^\circ\text{C}$
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	1300	
Power Dissipation	$P_D$	0.35	W
		0.22	
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	357	$^\circ\text{C}/\text{W}$
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$

**Notes**

a. Pulse width limited by maximum junction temperature.

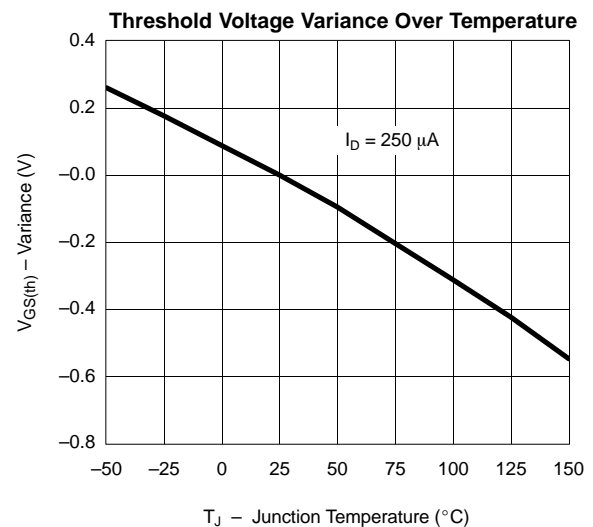
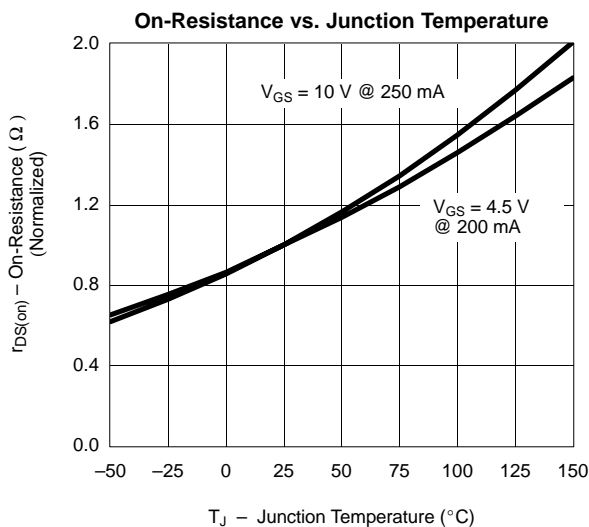
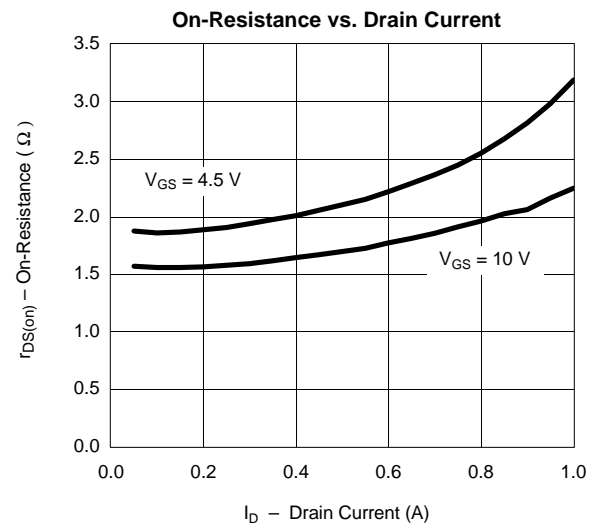
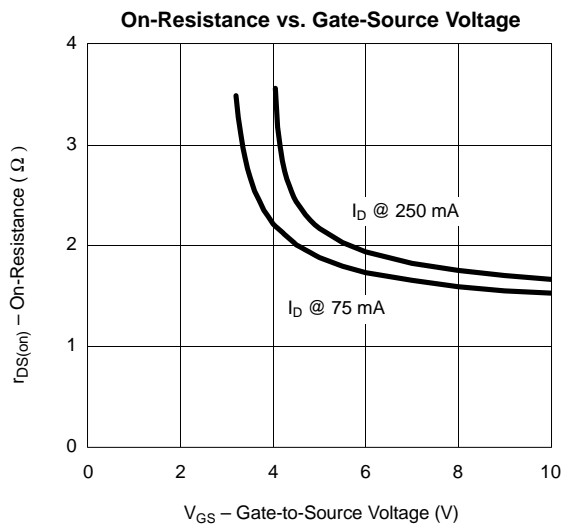
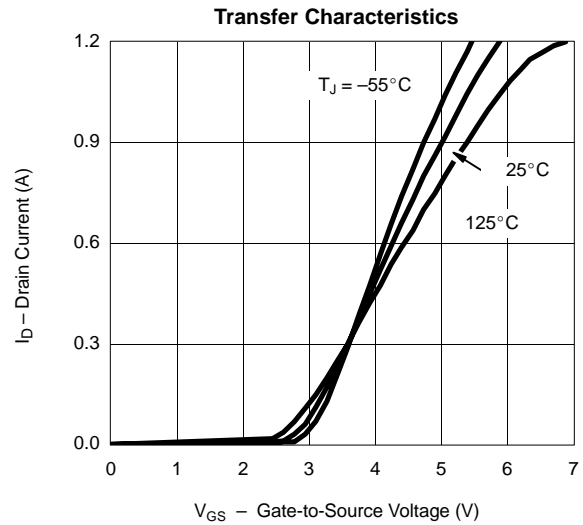
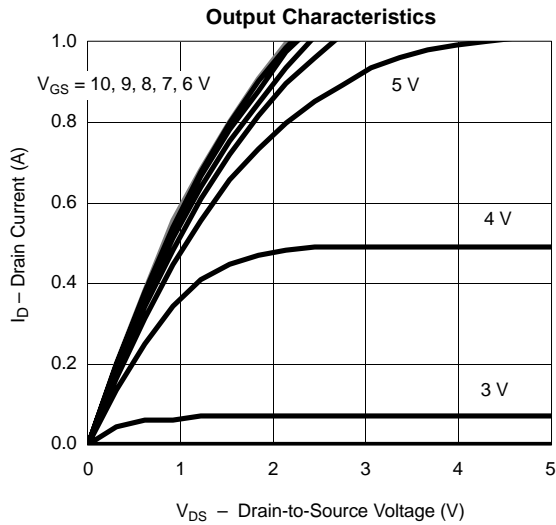
SPECIFICATIONS (T <sub>J</sub> = 25 °C UNLESS OTHERWISE NOTED)						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min	Typ <sup>a</sup>	Max	
<b>Static</b>						
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 10 μA	60	68		V
Gate-Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1	2	2.5	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 15 V			± 10	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>C</sub> = 125 °C			500	
On-State Drain Current <sup>b</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 7.5 V	800	1300		mA
		V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V	500	700		
Drain-Source On-Resistance <sup>b</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 250 mA		1.2	3	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 200 mA		1.8	4	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 200 mA		600		mS
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> = 200 mA, V <sub>GS</sub> = 0 V		0.85	1.2	V
<b>Dynamic<sup>a</sup></b>						
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V I <sub>D</sub> ≅ 250 mA		0.4	0.6	nC
Gate-Source Charge	Q <sub>gs</sub>			0.06		
Gate-Drain Charge	Q <sub>gd</sub>			0.06		
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz		21		pF
Output Capacitance	C <sub>oss</sub>			7		
Reverse Transfer Capacitance	C <sub>rss</sub>			2.5		
<b>Switching<sup>a, c</sup></b>						
Turn-On Time	t <sub>on</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 40 Ω I <sub>D</sub> ≅ 250 mA, V <sub>GEN</sub> = 10V R <sub>G</sub> = 10 Ω		13	20	ns
Turn-Off Time	t <sub>off</sub>			18	25	

## Notes

- a. For DESIGN AID ONLY, not subject to production testing.  
 b. Pulse test: PW ≤ 300 μs duty cycle ≤ 2%.  
 c. Switching time is essentially independent of operating temperature.



**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED)**



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